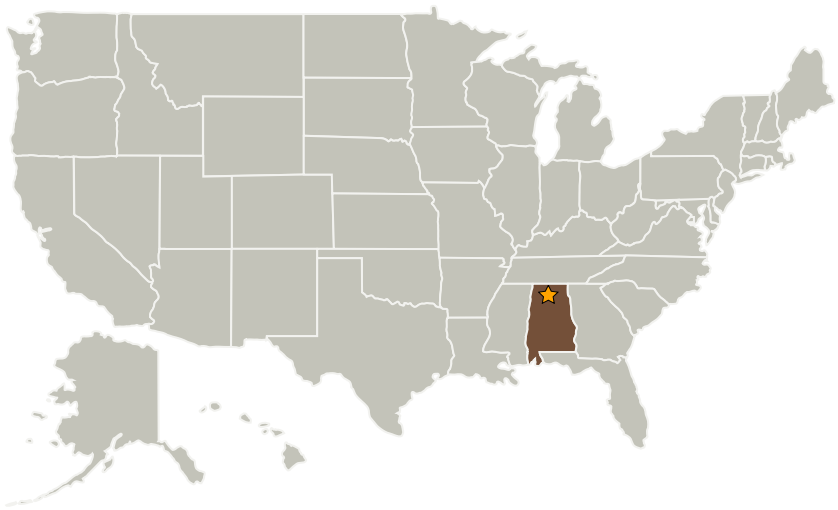
Advanced Nongray Radiation Module in the LOCI Framework for Combustion CFD, Phase II

Completed Technology Project (2007 - 2009)

Project Introduction

Radiative heat fluxes are important in the design of launch vehicles for Project Constellation. In this Phase II STTR, CFDRC and its partner Mississippi State University will develop an innovative, comprehensive, high fidelity radiation module in the LOCI CFD framework that will enable NASA to design/analyze heat transfer challenges that include radiation. In Phase I, CFDRC/MSU successfully demonstrated the feasibility of developing a radiation module in LOCI-Chem. A preliminary module was developed that included a gray gas model, as well as simplified nongray gas and particulate radiation capabilities. Following successful implementation and validation, LOCI-Chem with the radiation module was successfully applied to a Solid Rocket Motor (SRM) plume on a launch pad as a demonstration case. The proposed Phase II effort continues the development by: 1) implementing more accurate, robust nongray gas and particle radiation models, 2) increasing tool-fidelity by developing innovative methodologies to minimize modeling uncertainties, 3) formally verifying the module using the Method of Manufactured Solutions (MMS), and 4) validating the module and applying it to cases of direct relevance to NASA. NASA, ATK, and Pratt & Whitney Rocketdyne will be beta testers of the software in Phase II, and provide user feedback. At the end of Phase II, a final version of the software with full documentation will be delivered to NASA.

Primary U.S. Work Locations and Key Partners



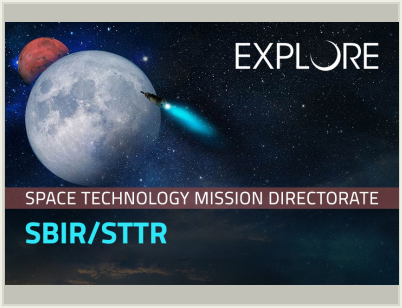


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Table of Contents

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Marshall Space Flight Center (MSFC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★Marshall Space Flight Center(MSFC)	Lead Organization	NASA Center	Huntsville, Alabama
CFD Research Corporation	Supporting Organization	Industry	Huntsville, Alabama

Primary U.S. Work Locations
Alabama

Project Transitions

May 2007: Project Start

August 2009: Closed out

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Technology Areas

Primary:

- TX09 Entry, Descent, and Landing
  - TX09.4 Vehicle Systems
    - TX09.4.5 Modeling and Simulation for EDL